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Research Article

Application of Panel Regression Model in Gender Studies in East Java

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ABSTRACT

Gender inequality remains one of the exciting issues to discuss. The role of women in social and economic continues to increase from year to year. This study aims to see the effect of the Gender Empowerment Index (GEI), Gender Development Index (GDI), and poverty rate on the Gender Inequality Index (GII) in East Java. Data sourced from the BPS-Statistics Indonesia of East Java Province for the 2018-2020 period. The statistical method used was multiple linear regression with panel data. Based on panel model testing, the random model is the best. Simultaneously, all variables affect the GII. Partially, GEI and GDI have a significant negative effect on GII. On the other hand, the percentage of poor people has a significant positive effect on GII. Based on the results of this study, comprehensive policies related to macro-social economics are needed so that the level of GII continues to decline.

Keywords*: GDI, GEI, GII, Panel, Poor people*

Introduction

The Gender Inequality Index (GII) is one of the indicators used to measure the level of inequality between men and women in various aspects of life, including education, health, economy, and political participation. East Java is one of the provinces in Indonesia that has problems in terms of gender inequality. Other gender-related measurements are the Gender Development Index and the Gender Empowerment Index (GEI).

According to BPS, GII can be divided into four class categories, namely low (less than 0.399), lower middle (range 0.400-0.449), upper middle (range 0.450-0.499), and high (more than or equal to 0.500). One of the provinces that experienced a decline in GII from year to year, based on data from the Central Statistics Agency (BPS), was East Java Province. In 2018, East Java's GII was 0.48 points; in 2020, it was 0.45 points, and in 2022, it was 0.44 points. This decline can be caused by improvements in various empowerment sectors, including education, employment, and politics. However, GII East Java is still included in the medium category.

Various studies and measures related to gender inequality have been conducted. Aprilia Triani (2022) analyzed the effect of gender inequality on poverty. The results of this study

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show the influence of gender inequality on poverty. Oeliestina (2020) examines the influence of social variables, technology, and information on gender inequality. The results showed a strong, significant, and negative correlation between information technology social variables such as HDI and GDI with GII. Kertati (2020) analyzed the Gender Development Index (GDI) and Gender Empowerment Index (GEI) of Surakarta city. The results of the overall analysis of the achievements of GDI and GEI of Surakarta City show a position above the average achievement of Central Java Province. Furthermore, Marsono (2021) analyzed spatial models on the gender inequality index in Indonesia. The results obtained by GDI affect GII, while GEI has not had a significant effect on GII.

Examining the factors that influence gender inequality can help in efforts to achieve equality and justice between men and women. On the other hand, increasing the role of women in gender-oriented development is an integral part of national development. By examining the factors that influence gender inequality, we can strengthen women's contributions in various sectors, including political, economic, and social fields.

Based on previous problems and various studies, this study modeled the effect of the Gender Development Index, Gender Empowerment Index, and Percentage of Poor People on the Gender Inequality Index. The method used is panel data regression analysis. This study used a time reference of 2018-2020 in all East Java City Districts.

Methodology

The data used in this study came from the publication of the Central Bureau of Statistics of East Java Province. This research focuses on all urban districts in East Java with a research period of 2018-2020. The dependent and independent variables in this study can be seen in Table 1.

Table1. Variable Research

Dependent Variables	Unit	Data Scale
Gender Inequality Index (GII)	Points	Ratio
Independent Variables	**Unit**	**Data Scale**
Gender Development Index (GDI)	Points	Ratio
Gender Empowerment Index (GEI)	Points	Ratio
Percentage of Poor People	Percent	Ratio

This research uses quantitative analysis methods, namely, influence modeling between variables (Sugiyono, 2019). The statistical model used to determine the influence between variables is a multiple linear regression analysis model (Ghozali, 2018). In this case, the regression model used is panel data regression analysis. There are three types of modeling in panel data regression, namely, common/pooled model, *fixed-effect* model, and random effect model (Baltagi, 2005). Model selection tests are performed to determine the best model that informs the relationship between variables. Panel selection tests can be seen in Table 2.

Table2. Panel Model Selection Test

Panel Model Test	Null Hypothesis	Alternative Hypotheses
LM BP Tests	A pooled/common model is better than Fixed	Fixed model is better than Pooled/ common model
Chow Test	A pooled/common model is better than a Random	Random model is better than Pooled/Common Model
Hausman test	A random model is better than a Fixed	A fixed model is better than a Random

After selecting the best model, a classic assumption test is carried out. This test is performed to ensure that the model can be used to see the influence between variables and predict the value of the dependent variable from the known value of the independent variable (Gujarati, 2004). The classical assumption test can be seen in Table 3.

Table3. Classical Assumption Test

Assumption Test	Zero Hypothesis	Alternative Hypotheses
Skewness Kurtosis	Normal distributed data	Data is not normally distributed
Breusch Pagan Test	Homokedastis data variants	Heterokedastis data variants
Wooldridge Test	Non-Autocorrelation Model	Autocorrelation Model

Once the best model has been selected and meets the classical assumptions, the next step is to test the model's goodness (Walpole, 2012). The merits of model tests can be seen in Table 4. After all the test criteria of the model are met, the interpretation of the formed regression equation is carried out.

Table4. Goodness Test Model

Goodness of Fit Test	Null Hypothesis	Alternative Hypotheses	Reject Ho
Test Coefficient of Determination / adjusted R square	R square > 0.5		
Simultaneous Test / F Test	Model Not fit/ All variables have no effect	Model fit / at least one variable has a significant effect	Prob.< 0.05
Partial Test / T Test	Certain independent variables have no effect	Influential independent variables	Prob.< 0.05

The hypotheses in this study are:

H1: The Gender Development Index has a significant negative effect on the Gender Inequality Index

H2: The Gender Empowerment Index has a significant negative effect on the Gender Inequality Index

H3: Percentage of Poor People Has a significant.

Results and Discussion

The discussion in this study begins by using descriptive analysis to determine the characteristics of each variable in the study during the research period. Table 5 shows a descriptive analysis. The average GII score was 0.41 points, with the highest value of 0.85 points in Bangkalan Regency in 2018 and the lowest of 0.06 points in Madiun City in 2018. The average GEI score was 68.17 points, with the highest score of 84.46 points in Kediri City in 2019 and the lowest of 49.67 points in Sampang Regency in 2018. The average GDI score was 90.53 points, with the highest score of 97.80 points in Kediri City in 2019 and the lowest of 80.11 points in Sumenep Regency in 2018. The average value of the percentage of poor people is 10.73 percent, with the highest value of 22.78 percent in Sampang Regency in 2020 and the lowest of 3.81 percent in Batu City in 2019.

Table5. Descriptive Analysis

Variable	Obs	Mean	Max	Min	Std
GII	114	0,41	0,85	0,06	0,14
GEI	114	68,17	84,46	49,67	7,92
GDI	114	90,53	97,80	80,11	3,89
Poor	114	10,73	22,78	3,81	4,41

The requirement in the regression model is that there is no high multicollinearity between independent variables, as seen from the Variant Inflation Factor (VIF) value of less than 10. In Table 6, all independent variables had VIF values less than ten in this study. This result means all independent variables are used in the model.

Table6. Multicollinearity Test

Variable	VIF	1/VIF
Poor	2,37	0,422
GDI	1,94	0,514
GEI	1,42	0,704

Before further analyzing modeling in panel data regression analysis, panel model selection is carried out. We used the tests mentioned in the methodology section through the three tests in Table 7. Random effect models are considered the best for describing relationships between research variables.

Table7. Panel Model Test

Test	Test Value	Prob. Value	Conclusion
LM BP Test	10,17	0,00	Random model is better than Common/Pooled Model
Chow Test	2,51	0,00	Fixed model is better than Common/Pooled Model
Hausman test	4,52	0,21	A random model is better than a Fixed Model

Once the panel model is selected, then the selected panel model is not interpreted directly but tested for classical assumptions. This test is intended so that the selected model can be used to see the effect of prediction. The assumptions used are the assumptions of normality, heteroscedasticity, and autocorrelation.

In Table 8, all assumptions are met. The probability value is more significant than 0.05. Table 9 shows a comparison between the three models. In pooled and random models, it can be seen that all variables have a significant effect.

Table8. Classical Assumption Test

Test	Test Value	Prob. Value	Conclusion
Normality Test	0,21	0,899	Normal distributed data
Breusch–Pagan Test	1,93	0,164	Homokedastis variants
WooldrGEIe Test	1,99	0,165	Non-Autocorrelation

Table9. Panel Model Comparison

Variable	pooled	fixed	random
GEI	-0,005***	-0,005*	-0,005***
GDI	-0,013***	-0,005	-0,013***
Poor	0,010***	-0,017	0,009***
cons	1,932***	1,468	1,977***
r2	0,777	0,105	0,777
F/ chi2	127,953	2,856	222,456
p	0,000	0,0428	0,000

Legend: * p<0.05; ** p<0.01; p<0.001

From Table 9, the value of the coefficient of determination is 0.777. The value of this coefficient means that all independent variables can account for the GII variation of 77.7 percent; Other variables outside the model influenced the remaining 22.3 percent. The chi-square test shows that all independent variables together affect IPEI. This result is identified by the statistical probability value chi square = 0.000, smaller than alpha = 0.05. These results mean that the modeling performed is appropriate.

In Table 10 below, the partial test identified with the probability value of the statistical z-test shows that all significant variables are influential where the probability value is 0.000 < alpha 0.05. When viewed from the coefficients, GEI and GDI variables have a significant negative effect on GII. On the other hand, poverty has a significant positive effect on GII. The regression equation is formed:

$\widehat{IKG}$ = 1,977 - 0,005 GEI - 0,0138 GDI +0,009Miskin

Table 10. Random Model Hypothesis Testing

GII	Coef	S.E	Z Stat	Prob
GEI	-0,005	0,001	-5.34	0.000
GDI	-0,013	0,002	-4.87	0.000
Poor	0,009	0,002	3.46	0.001
Cons	1,977	0,290	6.81	0.000

Discussion

GEI has a significant negative influence on GII with a coefficient of -0.005, with a value of |z stat| = 5.34> z table = 1.96 and a prob value = 0.000 < alpha = 0.05. This result means that every 1-point increase in GEI will decrease GII by 0.005 points, assuming the other variables are constant. This result is in line with research by Kabeer (2005) and Oeliestina (2020), which states that GEI affects GII.

GDI has a significant negative influence on GII with a coefficient of -0.013, with a value of |z stat| = 4.87> z table = 1.96 and a prob value = 0.000 < alpha = 0.05. This result means that every 1-point increase in GDI will decrease GII by 0.013 points, assuming the other variables are constant. This result is in line with the research of Klasen (2010) and Marsono (2021), which states that GDI affects GII. GII shows the potential for human development achievements that are lost due to the gender gap in the health dimension. In this case, an increase in GDI can indicate increased women's access to health, education, and employment services that can help reduce gender inequality (Oeliestina, 2020)

The percentage of poor people has a significant positive influence on GII with a coefficient of 0.009, with a value of |z stat| = 3.46> z table = 1.96 and a prob value = 0.001 < alpha = 0.05. This result means that every one percentage point increase in people with low incomes will raise the GII by 0.009 points, assuming other variables are constant. Limited access to resources: People living in poverty often face limited access to resources, including education, health, and employment (Raya, 2021). Gender inequality can be exacerbated when women and girls face more significant barriers to accessing these resources.

Conclusion and Suggestion

The random effect model was obtained as the best model based on panel model testing (Chow, LM BP, and Hausman). There is no violation of the classification assumption in the model used. The result is that all independent variables have a significant effect together on GII. Partially, GEI and GDI have a significant negative effect on GII. On the other hand, the percentage of poor people has a significant positive effect on GII.

Based on the results of this study, comprehensive policies related to macro-social economics are needed so that the GII level in East Java continues to decline. For further research, it is possible to add other potential independent variables affecting GII, such as economic growth, income inequality, unemployment, and others. Further modeling can use other panel models by using random effects or spatial effects in panel models.

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